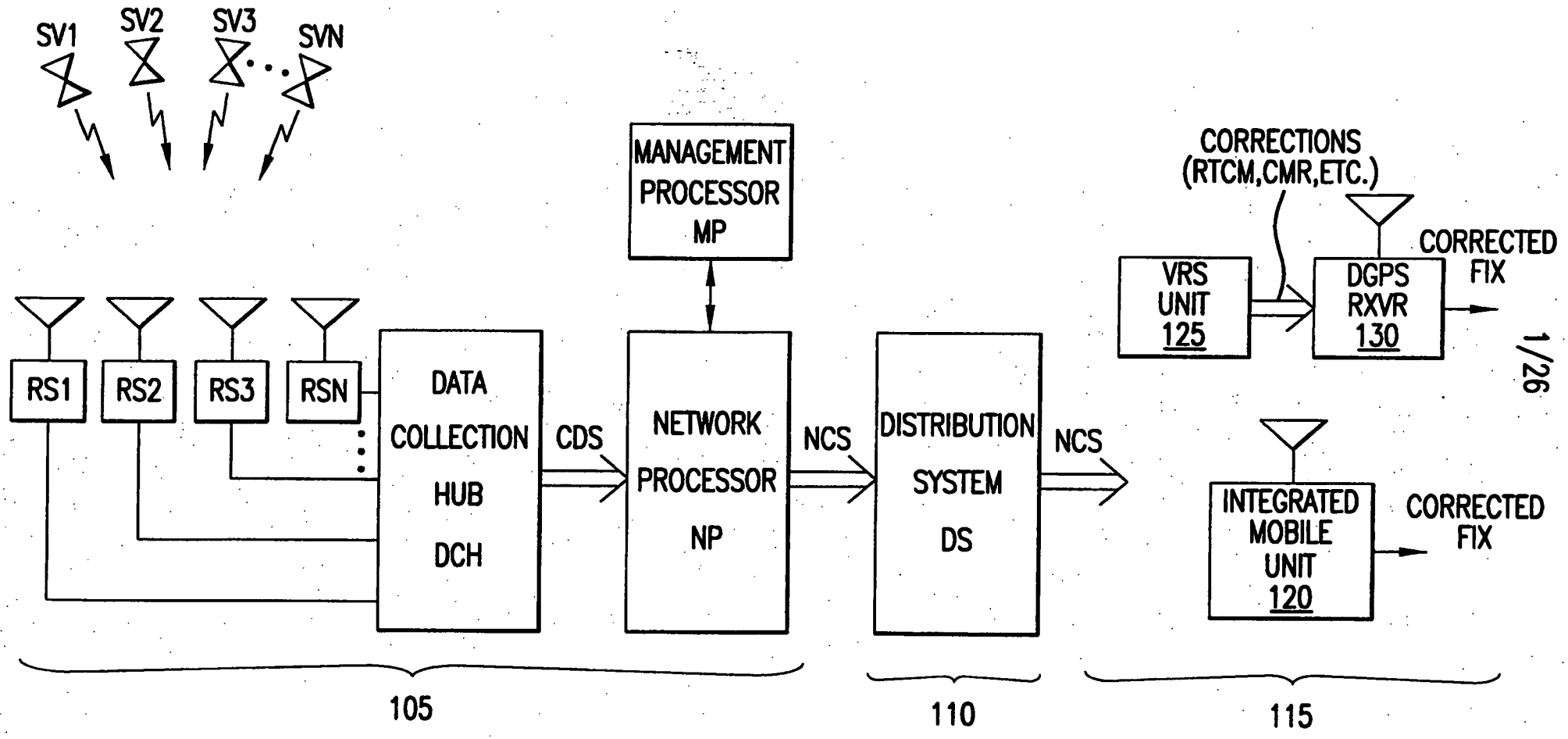

SV1
SV2
SV3
SVN
MANAGEMENT PROCESSOR MP
CORRECTIONS (RTCM,CMR,ETC.)
CORRECTED FIX
VRS UNIT 125
DGPS RXVR 130
RS1
RS2
RS3
RSN
DATA COLLECTION HUB DCH
CDS
NETWORK PROCESSOR NP
NCS
DISTRIBUTION SYSTEM DS
NCS
INTEGRATED MOBILE UNIT 120
CORRECTED FIX
105
110
115

1/26

FIG. 1

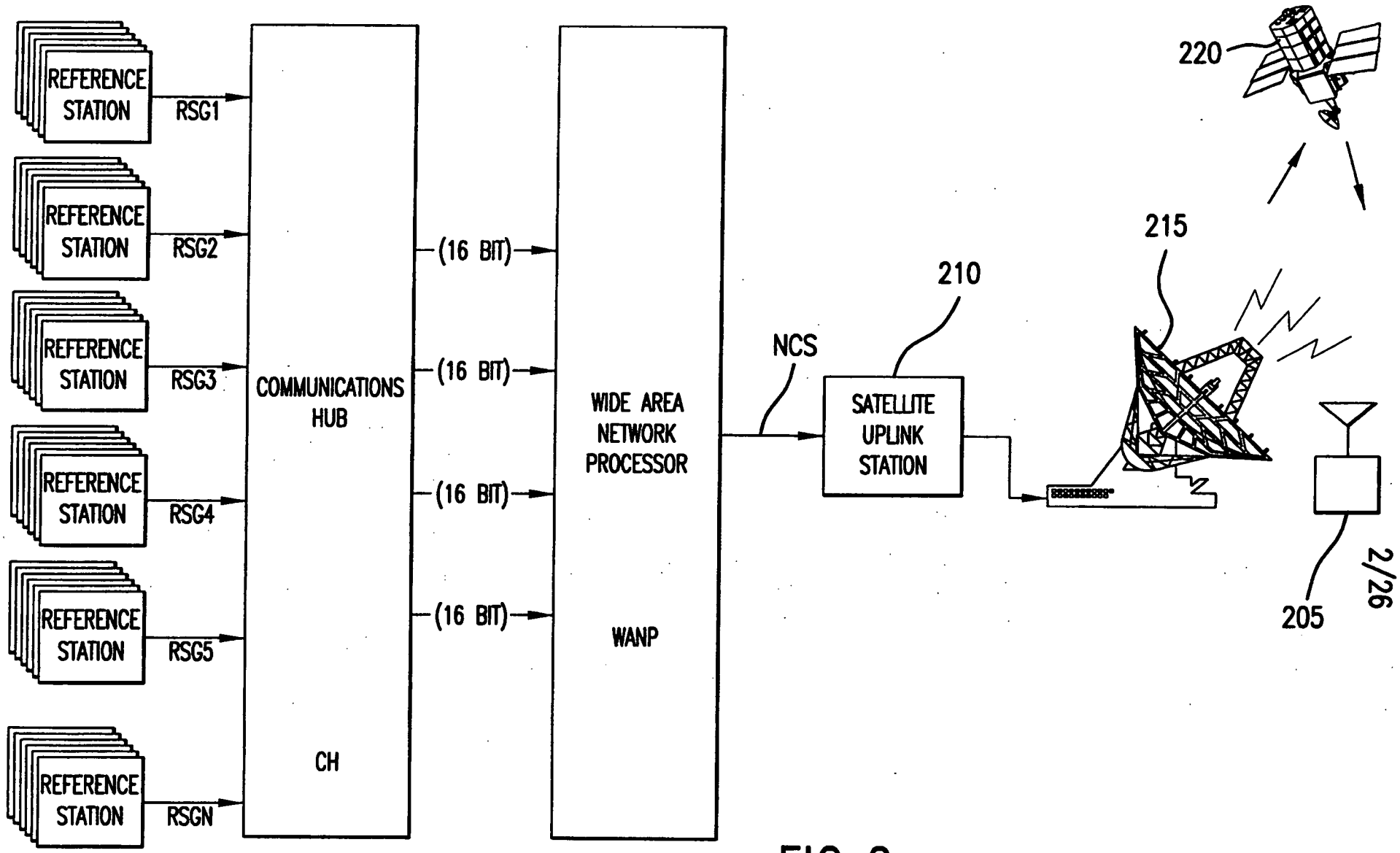

REFERENCE STATION
RSG1
REFERENCE STATION
RSG2
REFERENCE STATION
RSG3
REFERENCE STATION
RSG4
REFERENCE STATION
RSG5
REFERENCE STATION
RSGN
COMMUNICATIONS HUB
CH
(16 BIT)
(16 BIT)
(16 BIT)
(16 BIT)
WIDE AREA NETWORK PROCESSOR
WANP
NCS
210
SATELLITE UPLINK STATION
215
220
205

FIG. 2

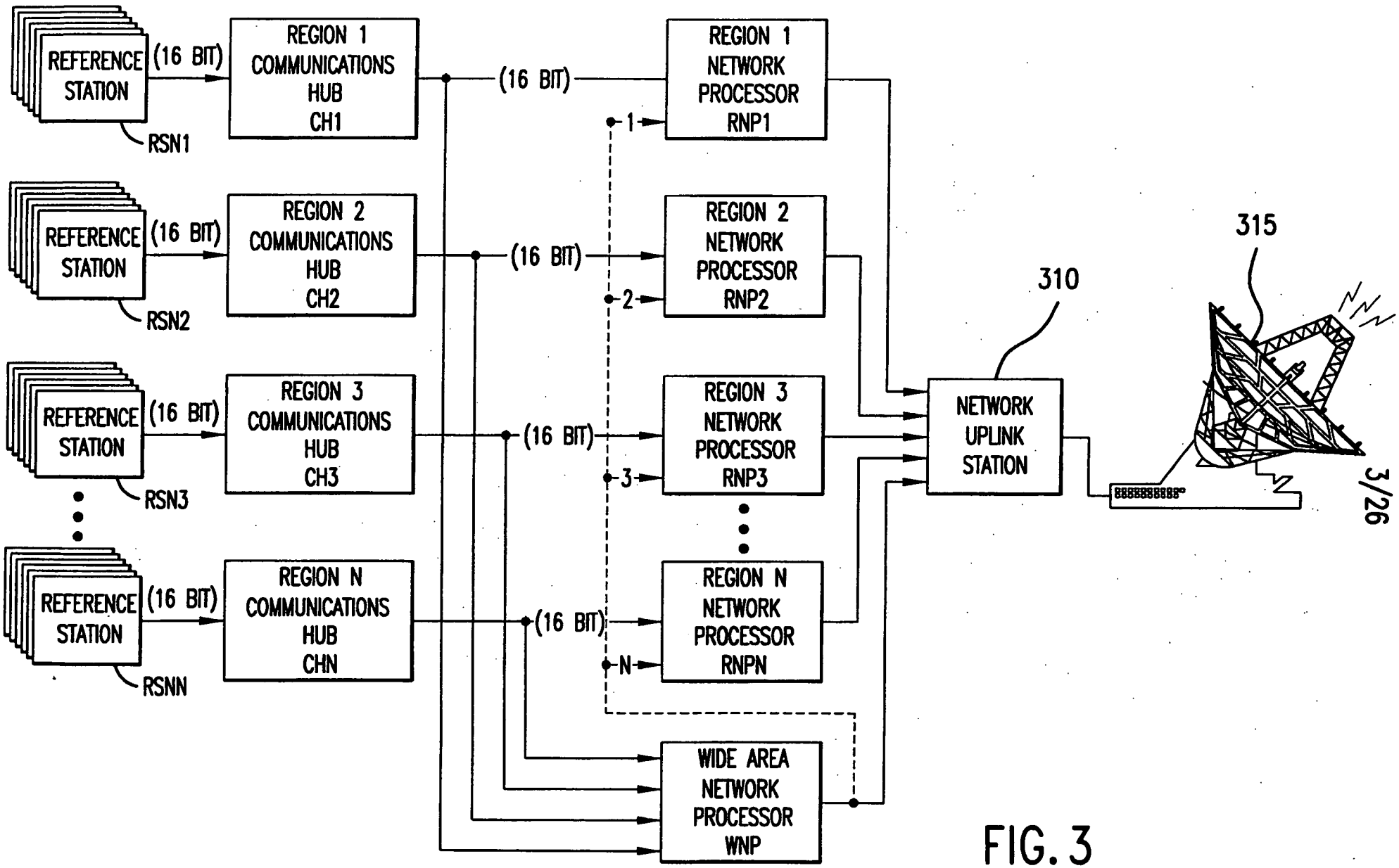

REFERENCE STATION
(16 BIT)
RSN1
REGION 1 COMMUNICATIONS HUB CH1
(16 BIT)
REGION 1 NETWORK PROCESSOR RNP1
1
REFERENCE STATION
(16 BIT)
RSN2
REGION 2 COMMUNICATIONS HUB CH2
(16 BIT)
REGION 2 NETWORK PROCESSOR RNP2
2
REFERENCE STATION
(16 BIT)
RSN3
REGION 3 COMMUNICATIONS HUB CH3
(16 BIT)
REGION 3 NETWORK PROCESSOR RNP3
3
REFERENCE STATION
(16 BIT)
RSNN
REGION N COMMUNICATIONS HUB CHN
(16 BIT)
REGION N NETWORK PROCESSOR RNPN
N
WIDE AREA NETWORK PROCESSOR WNP
NETWORK UPLINK STATION
310
315
3/26

FIG. 3

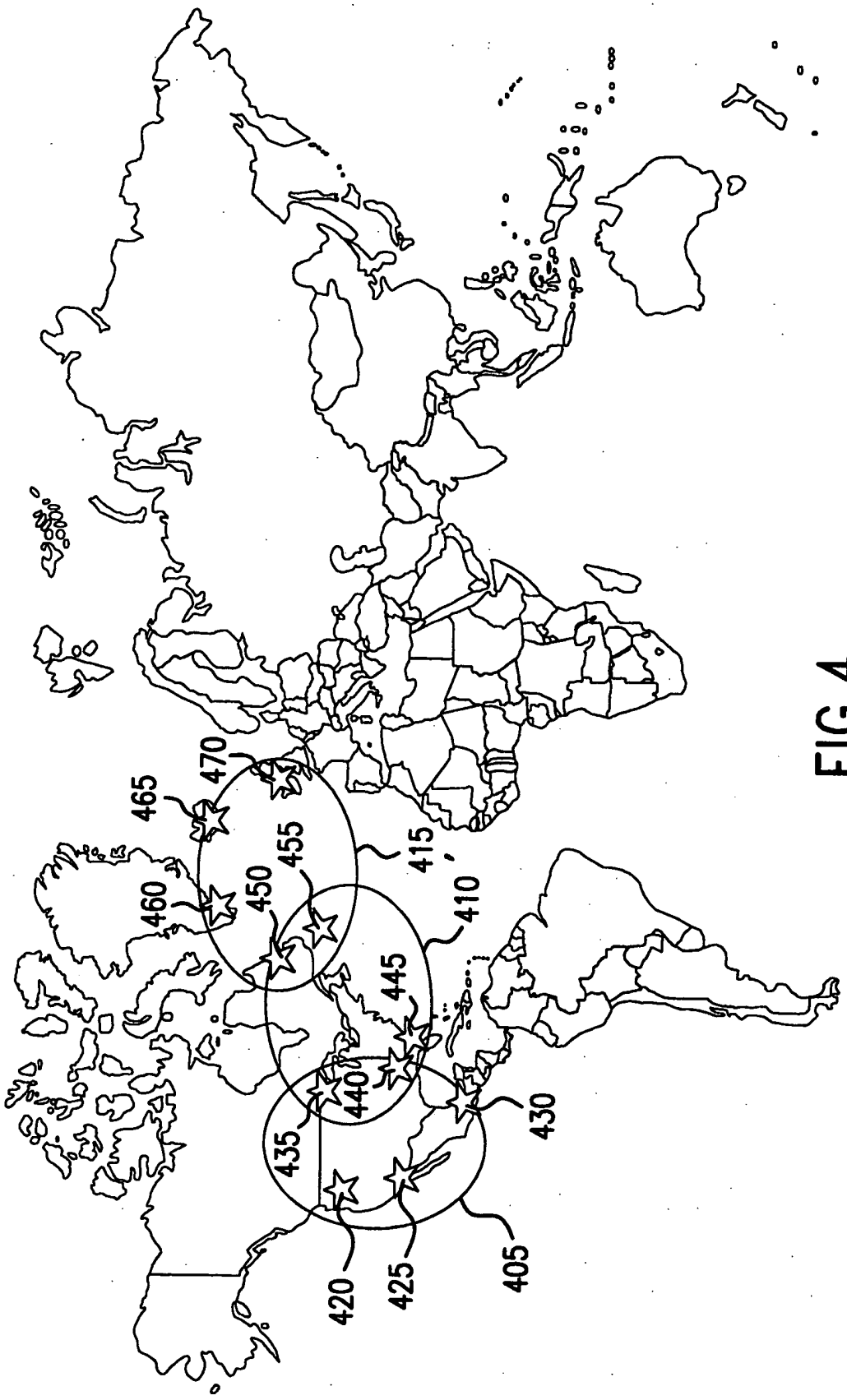


FIG.4

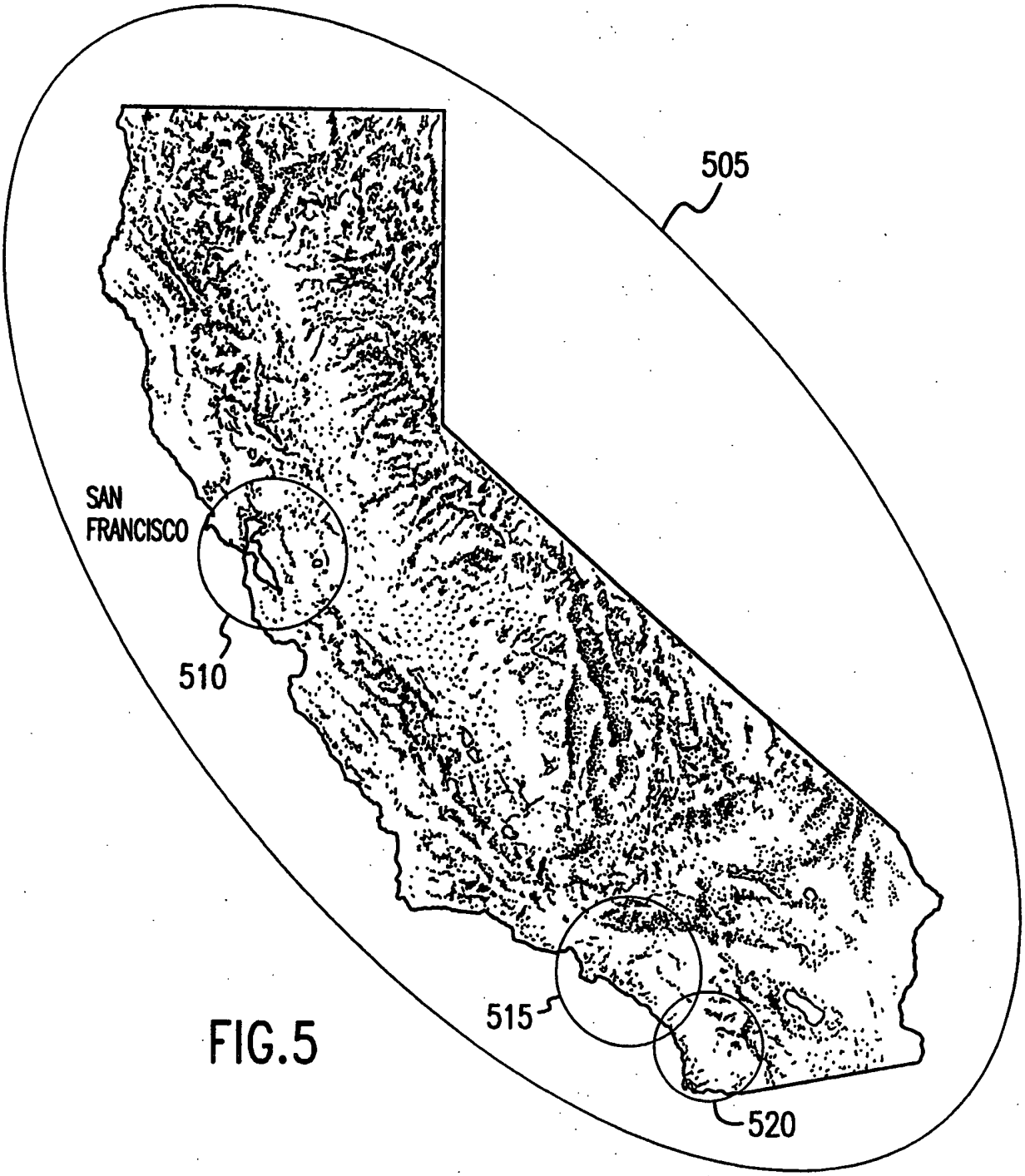


FIG.5

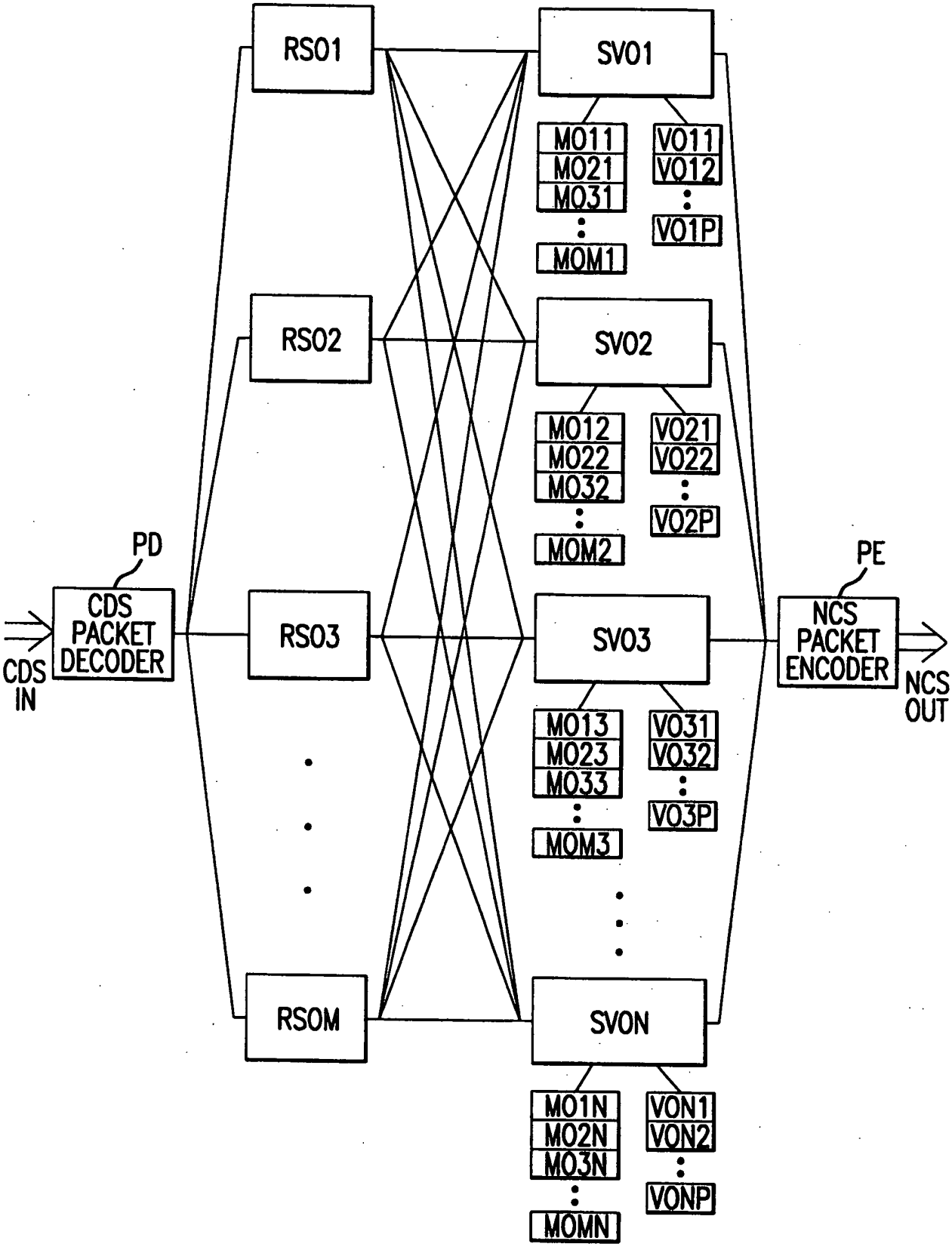

RS01
RS02
RS03
RSOM
SV01
SV02
SV03
SVON
MO11
MO21
MO31
MOM1
VO11
VO12
VO1P
MO12
MO22
MO32
MOM2
VO21
VO22
VO2P
MO13
MO23
MO33
MOM3
VO31
VO32
VO3P
MO1N
MO2N
MO3N
MOMN
VON1
VON2
VONP
PD
CDS
PACKET
DECODER
CDS
IN
PE
NCS
PACKET
ENCODER
NCS
OUT

FIG. 7

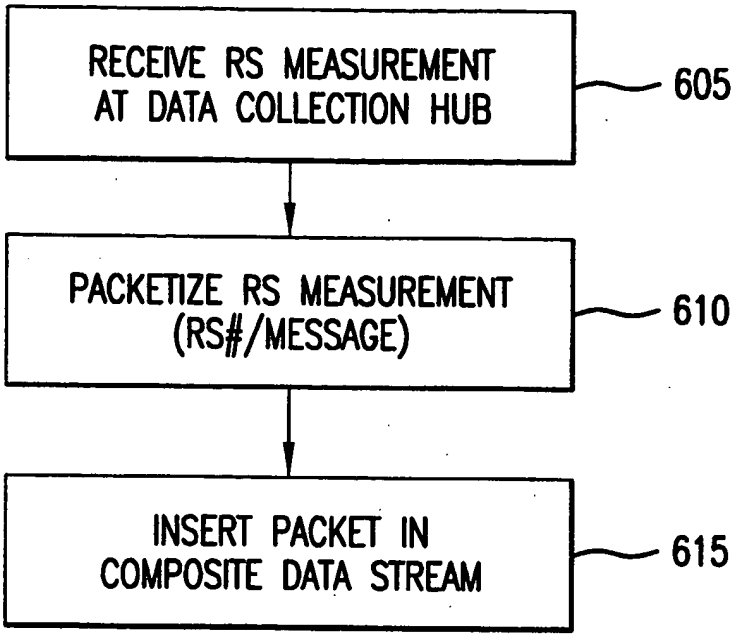

RECEIVE RS MEASUREMENT AT DATA COLLECTION HUB
605
PACKETIZE RS MEASUREMENT (RS#/MESSAGE)
610
INSERT PACKET IN COMPOSITE DATA STREAM
615

FIG. 6

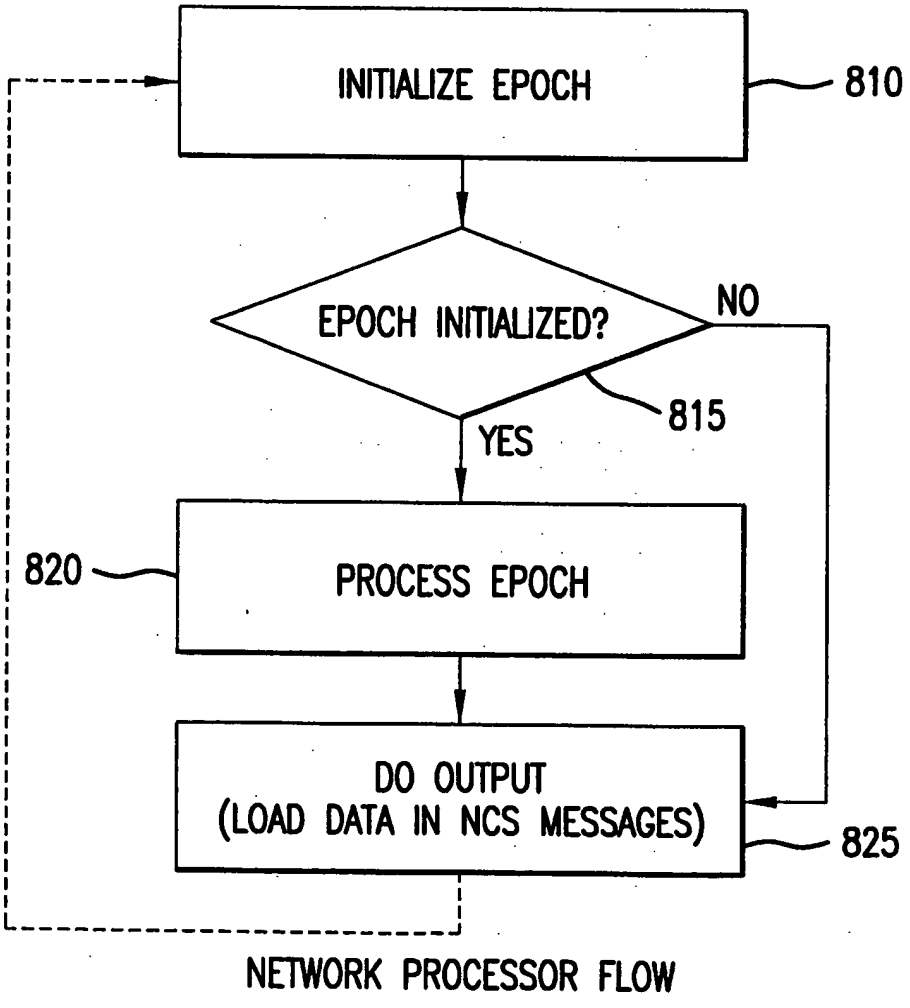
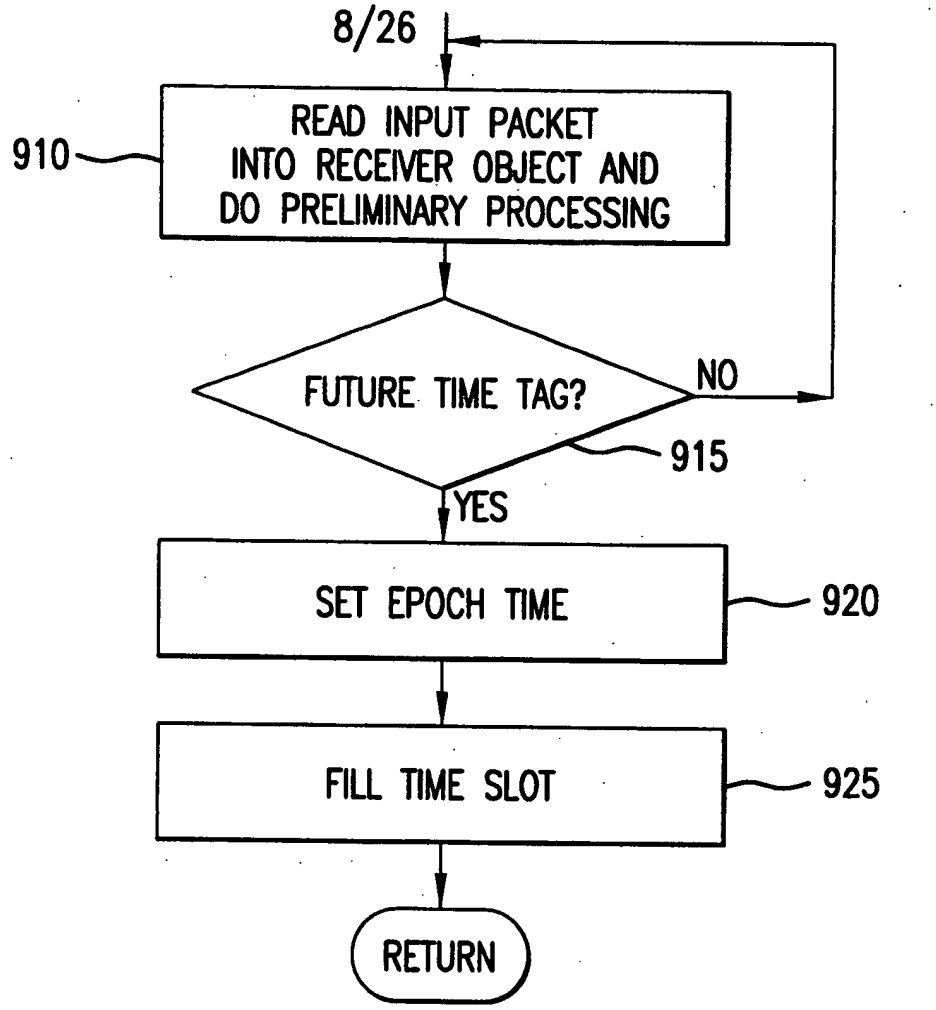
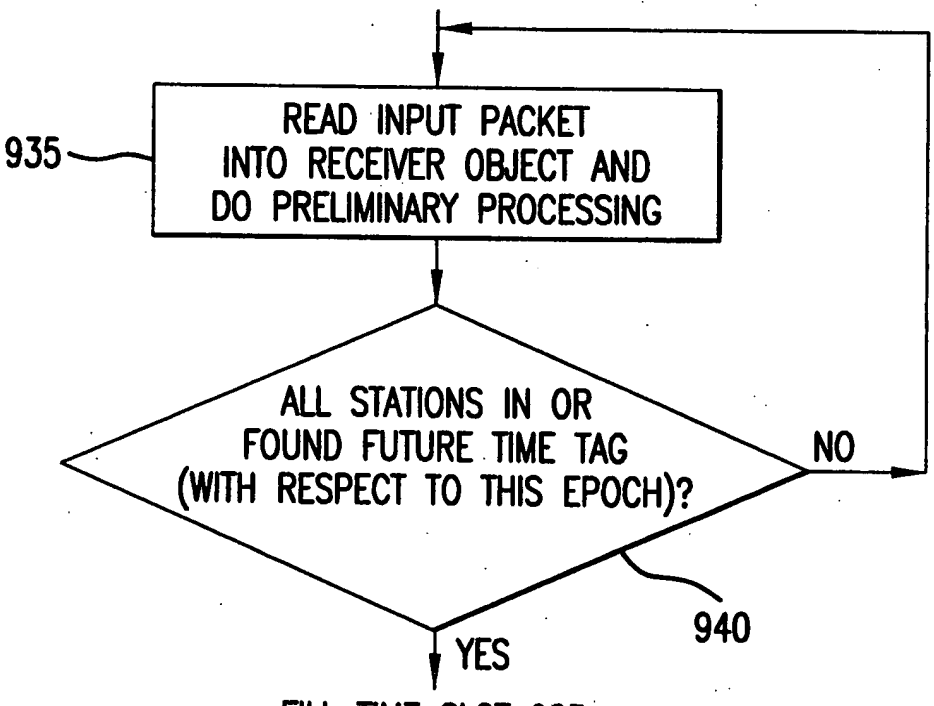

INITIALIZE EPOCH
810
EPOCH INITIALIZED?
NO
815
YES
820
PROCESS EPOCH
DO OUTPUT (LOAD DATA IN NCS MESSAGES)
825
NETWORK PROCESSOR FLOW

FIG. 8



INITIALIZE EPOCH 810

FIG. 9A



FILL TIME SLOT 925

FIG. 9B

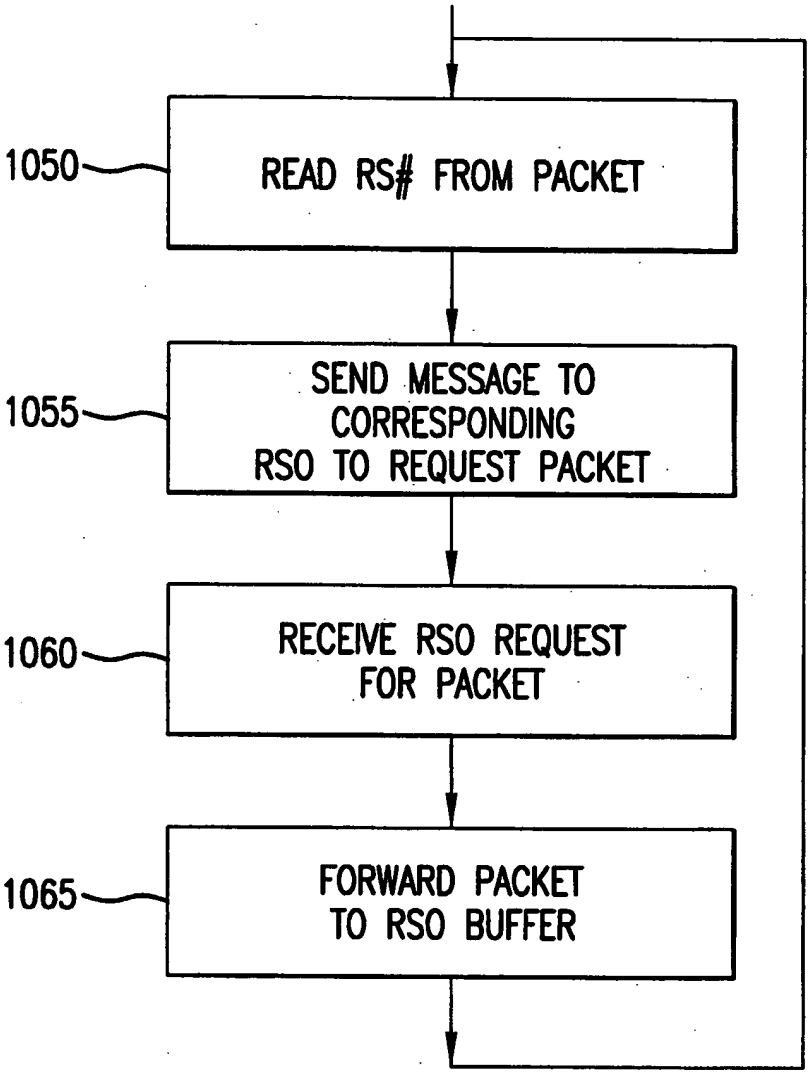

1050
READ RS# FROM PACKET
1055
SEND MESSAGE TO CORRESPONDING RSO TO REQUEST PACKET
1060
RECEIVE RSO REQUEST FOR PACKET
1065
FORWARD PACKET TO RSO BUFFER
READ INPUT PACKET 910a, 935a

FIG. 10

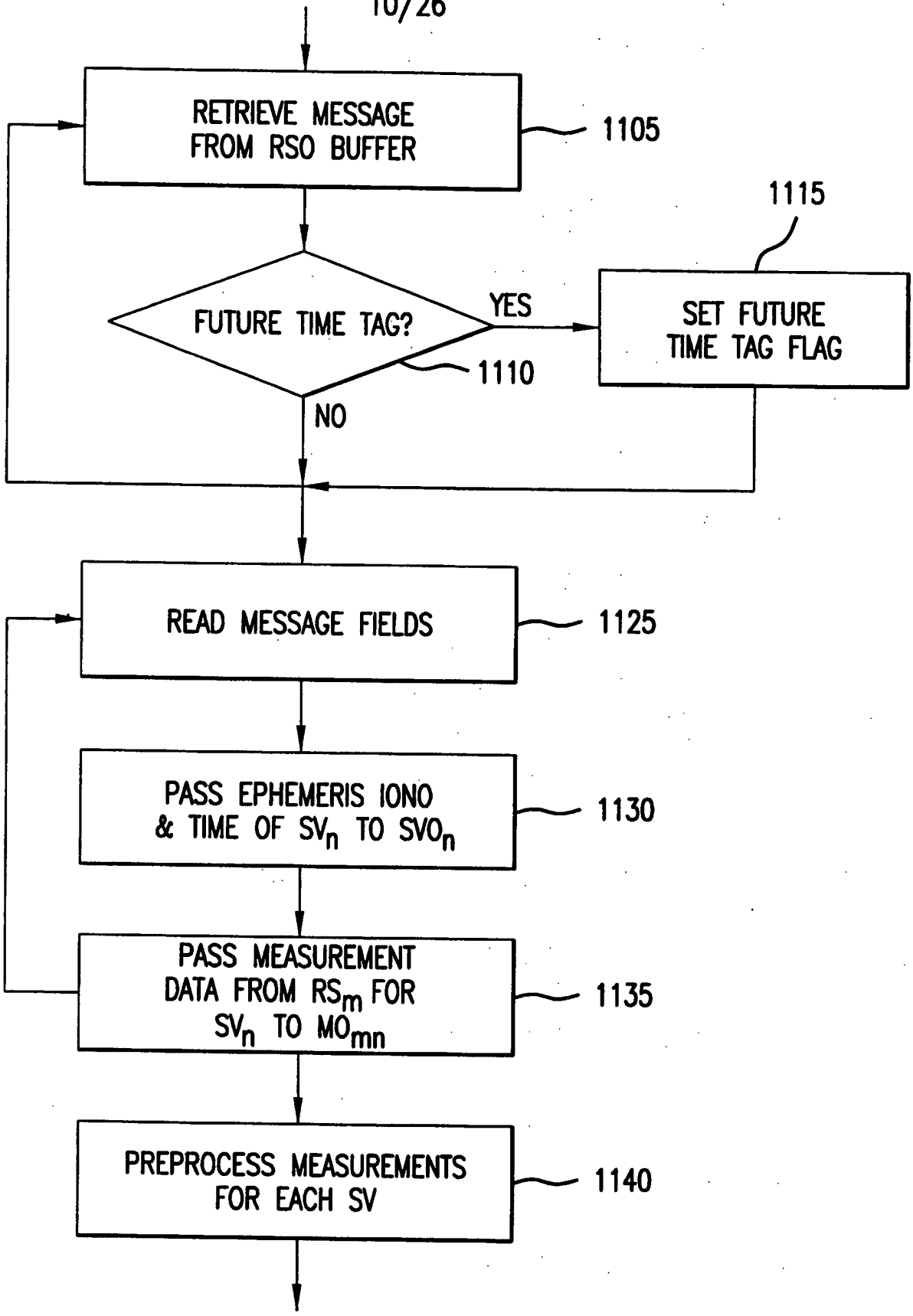
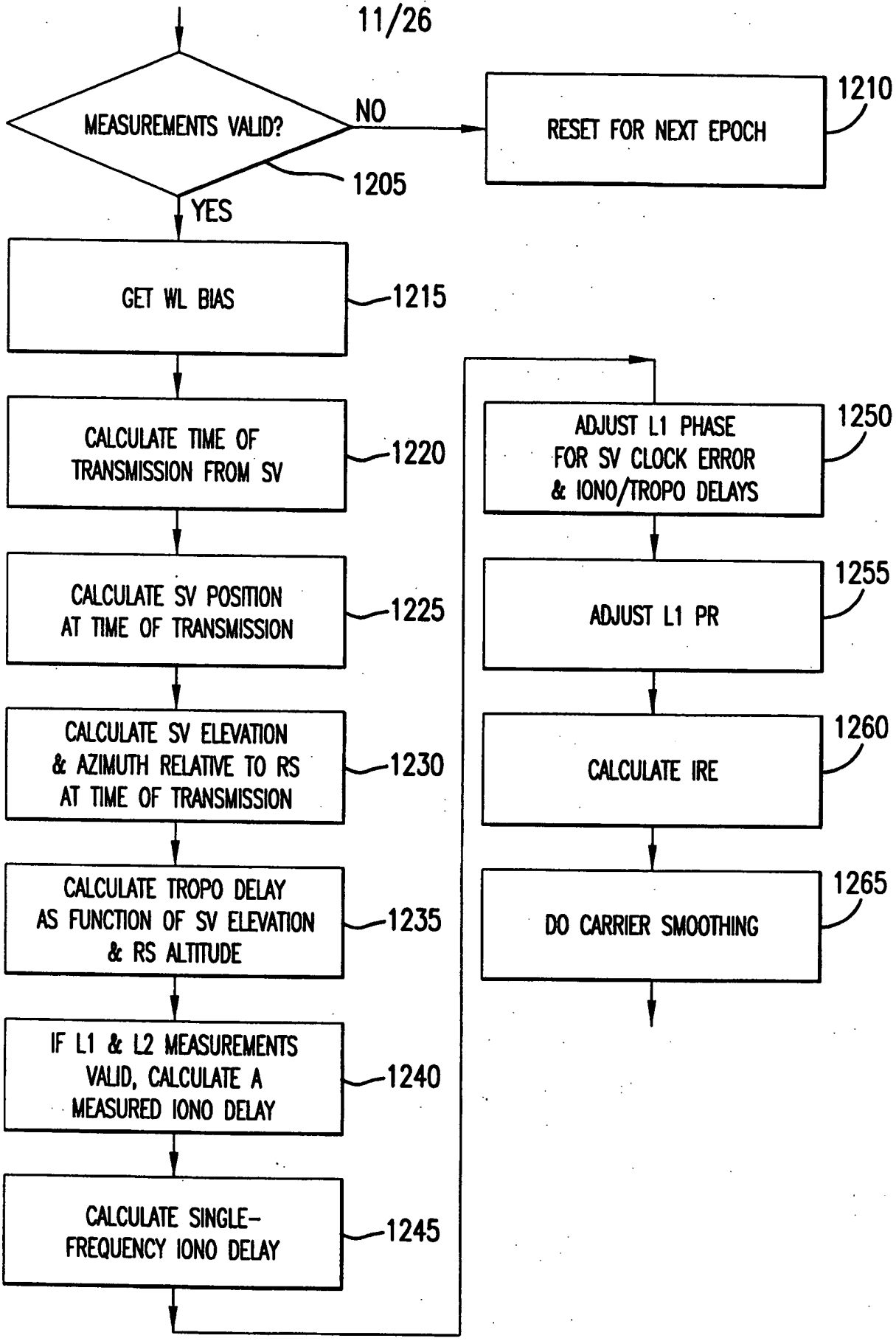
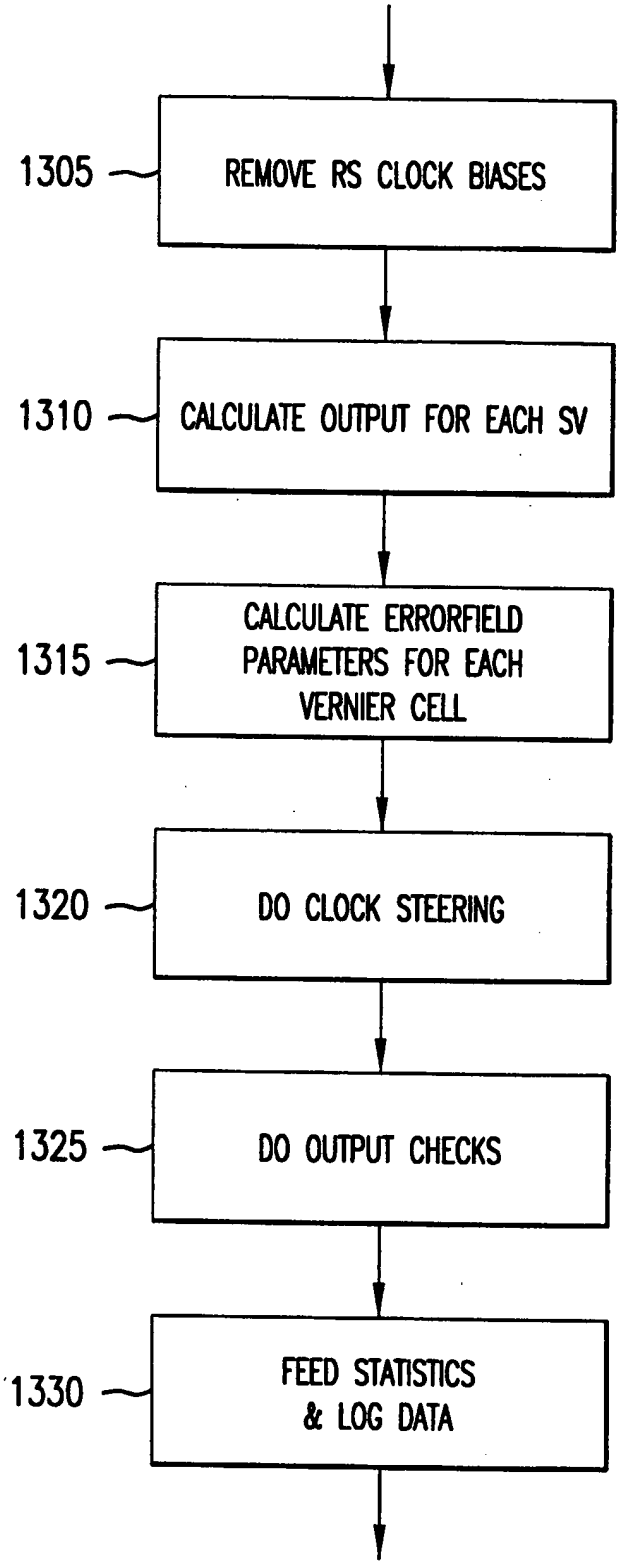

RETRIEVE MESSAGE FROM RSO BUFFER
1105
1115
FUTURE TIME TAG?
YES
SET FUTURE TIME TAG FLAG
1110
NO
READ MESSAGE FIELDS
1125
PASS EPHEMERIS IONO & TIME OF SV_n TO SVO_n
1130
PASS MEASUREMENT DATA FROM RS_m FOR SV_n TO MO_{mn}
1135
PREPROCESS MEASUREMENTS FOR EACH SV
1140
READ INPUT PACKET 910b, 935b

FIG. 11



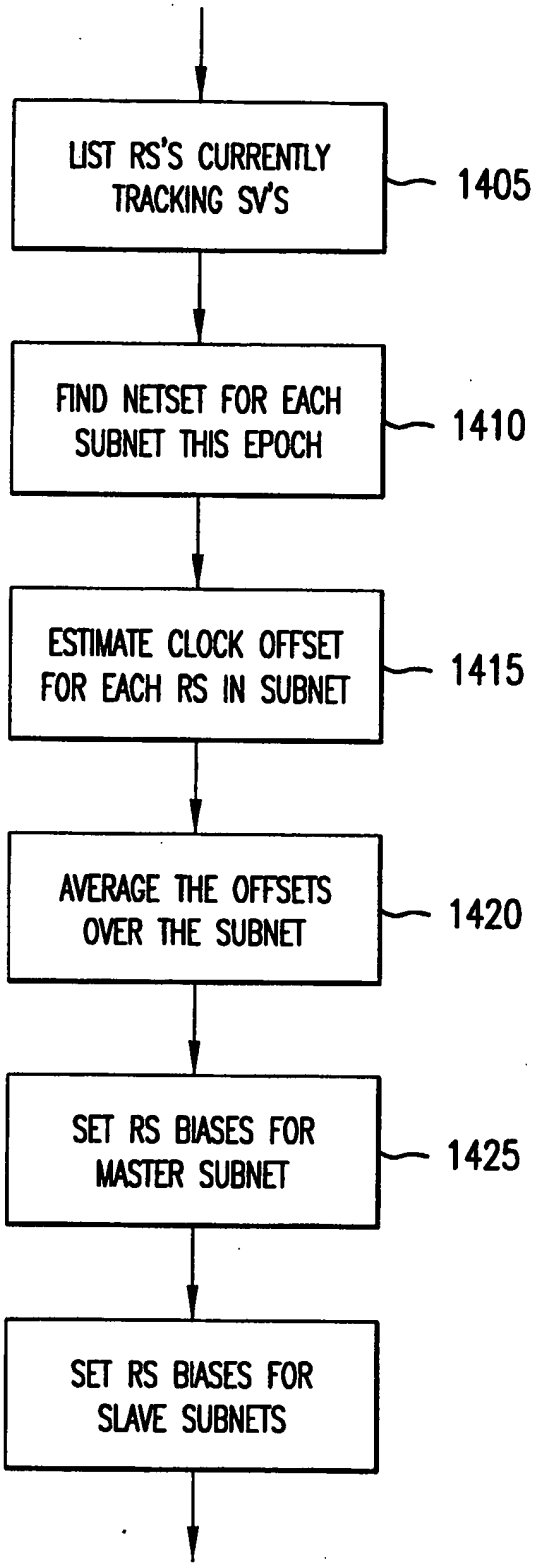
PREPROCESS MEASUREMENTS 1140

FIG. 12



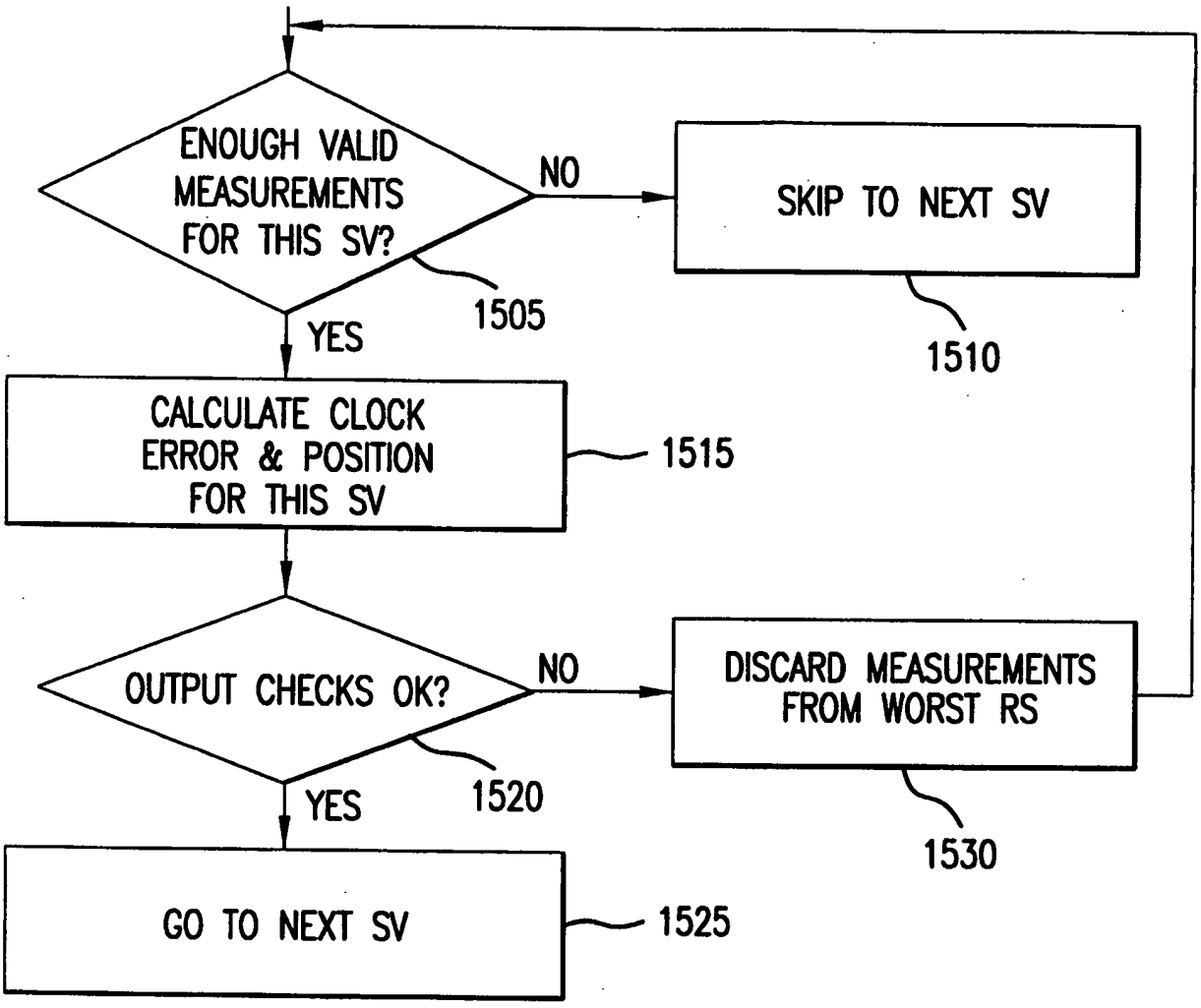
PROCESS EPOCH 920

FIG. 13



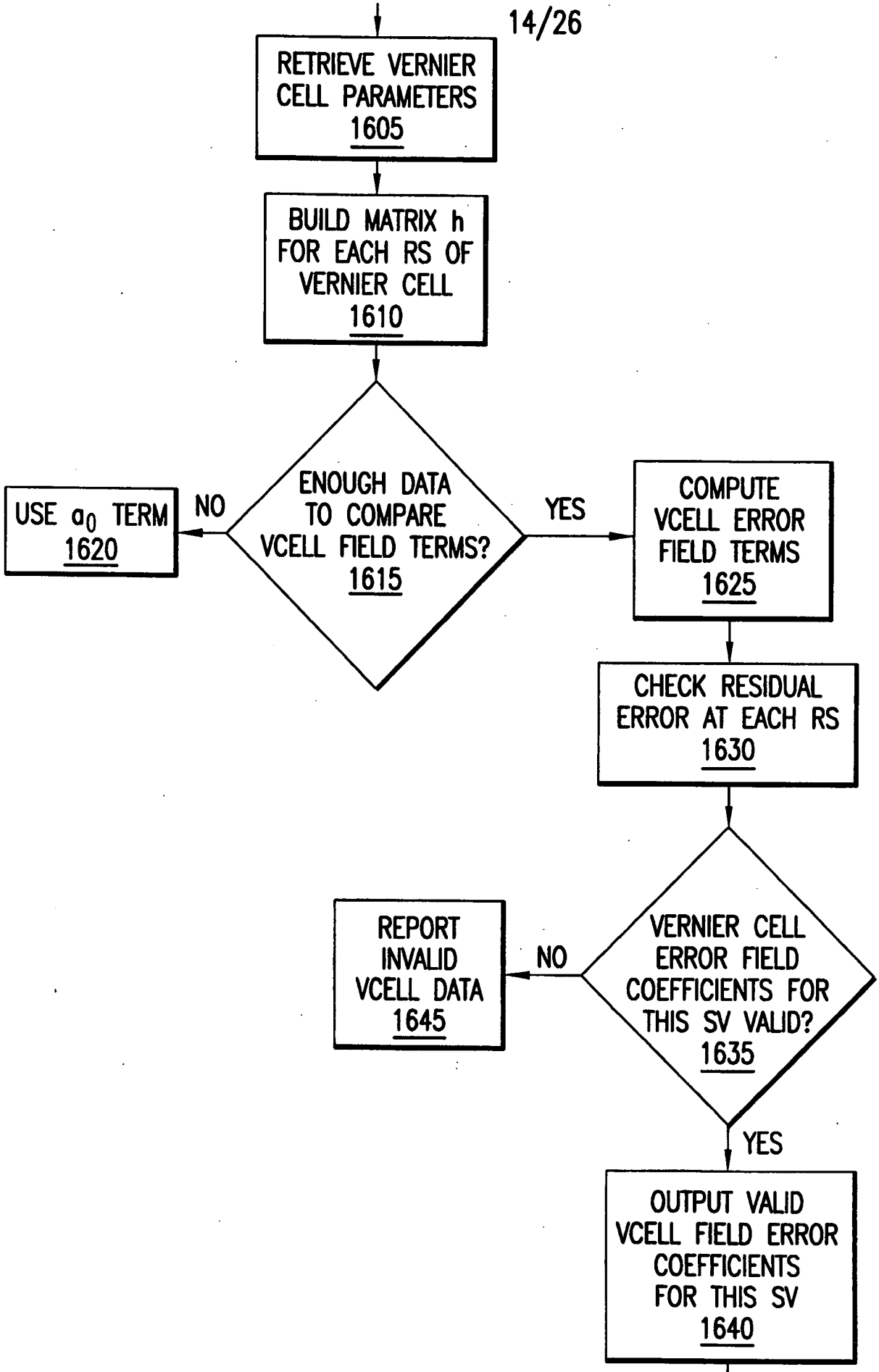
REMOVE RS CLOCK BIASES 1305

FIG. 14



CALCULATE OUTPUT FOR EACH SV 1310

FIG. 15



CALCULATE VERNIER CELL ERROR FIELD PARAMETERS 1315

FIG. 16A

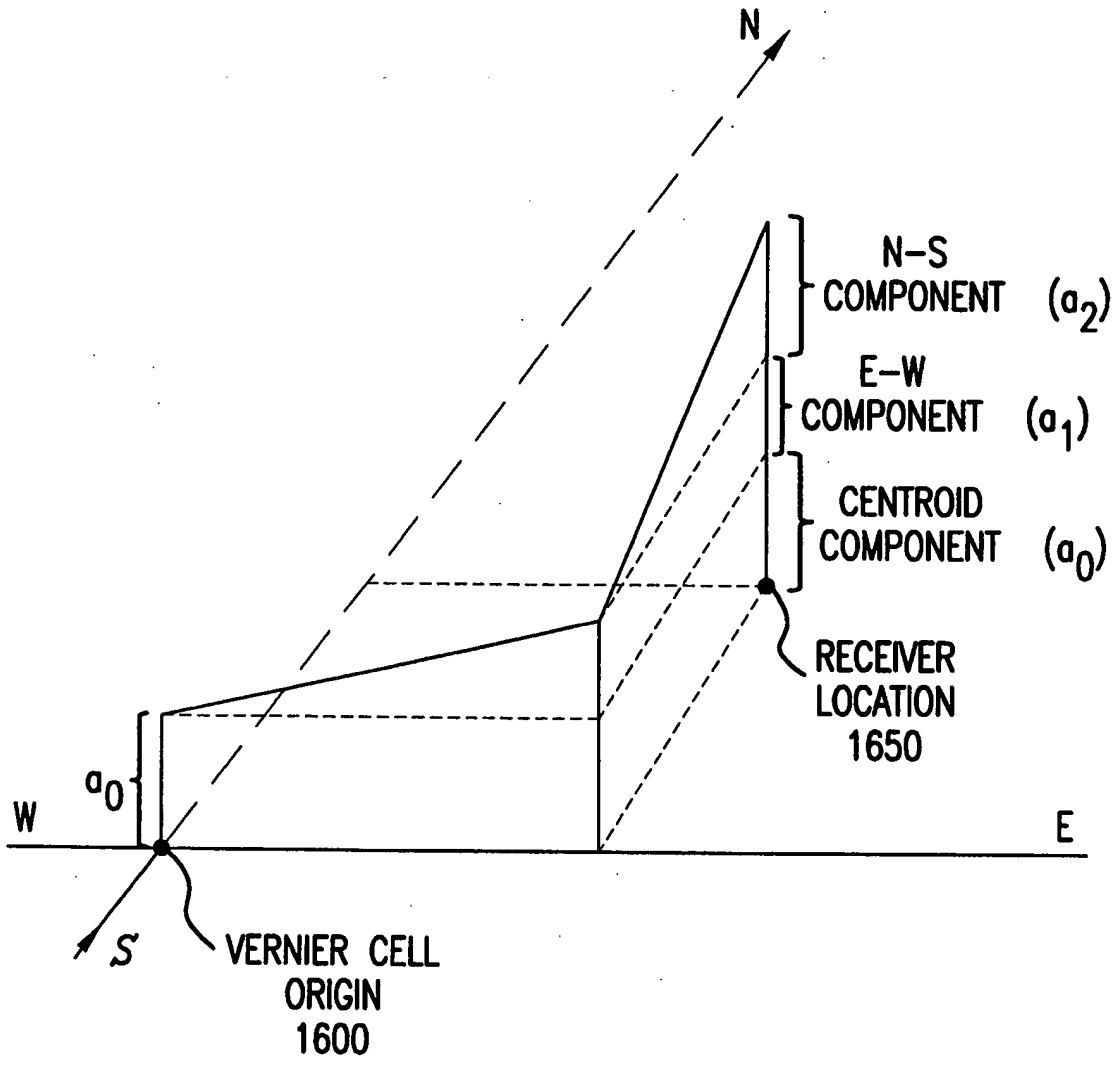

N
N–S
COMPONENT
(a_2)
E–W
COMPONENT
(a_1)
CENTROID
COMPONENT
(a_0)
RECEIVER
LOCATION
1650
a_0
W
E
S
VERNIER CELL
ORIGIN
1600

FIG. 16B

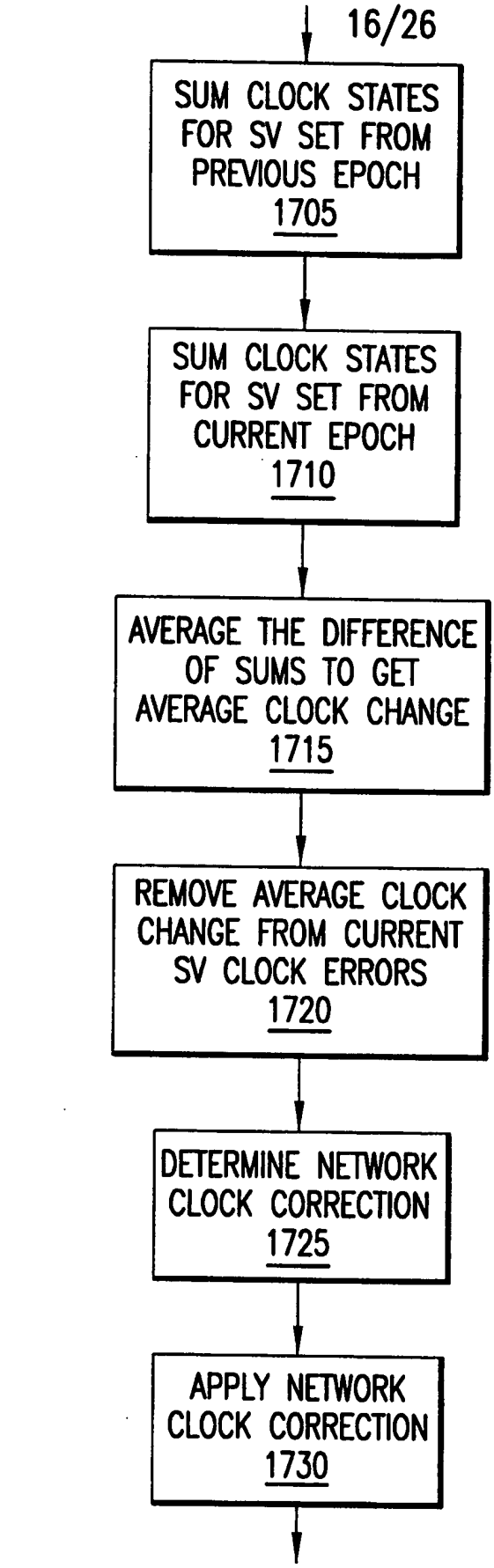

SUM CLOCK STATES FOR SV SET FROM PREVIOUS EPOCH 1705
SUM CLOCK STATES FOR SV SET FROM CURRENT EPOCH 1710
AVERAGE THE DIFFERENCE OF SUMS TO GET AVERAGE CLOCK CHANGE 1715
REMOVE AVERAGE CLOCK CHANGE FROM CURRENT SV CLOCK ERRORS 1720
DETERMINE NETWORK CLOCK CORRECTION 1725
APPLY NETWORK CLOCK CORRECTION 1730
DO CLOCK STEERING FOR EACH SV 1320

FIG. 17

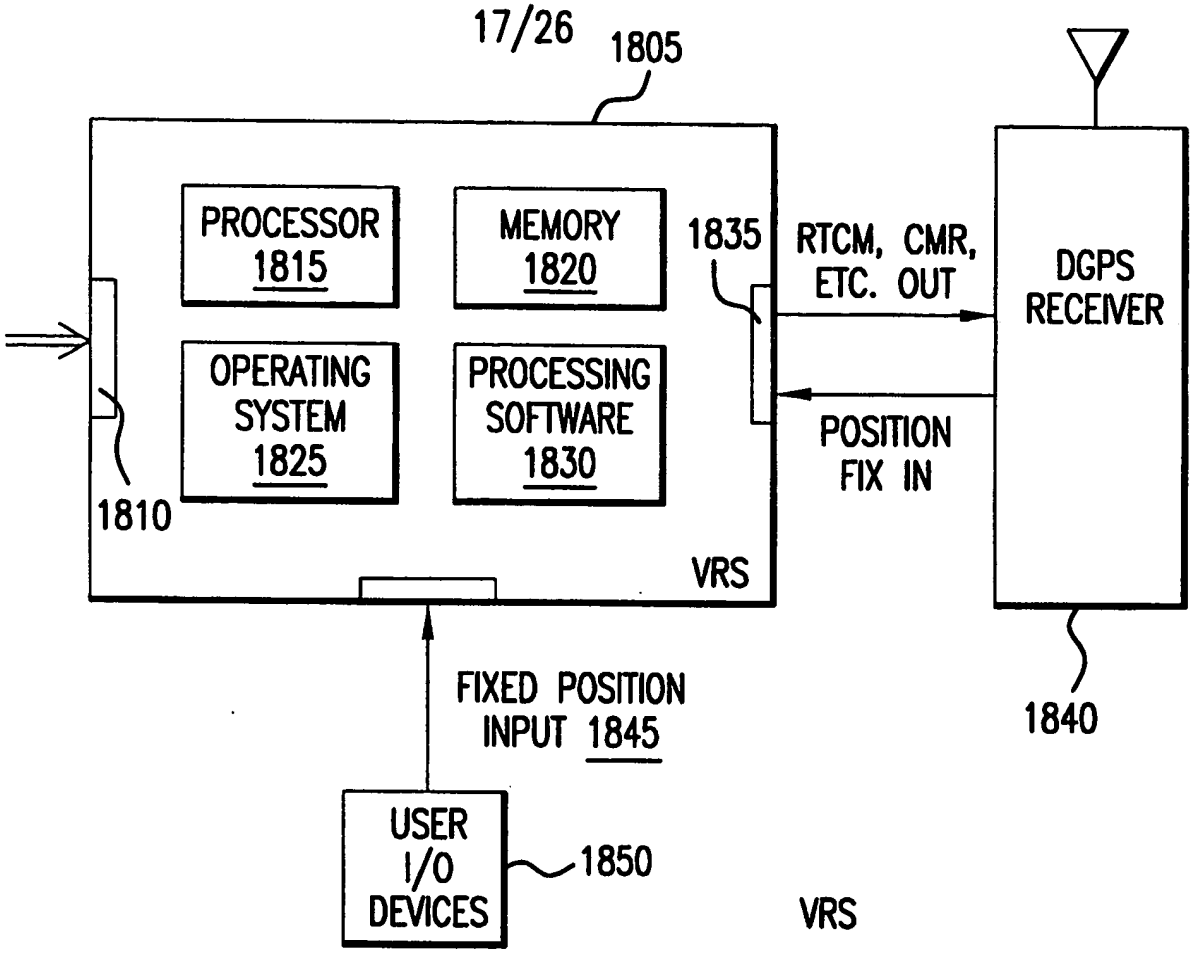

1805
PROCESSOR
1815
MEMORY
1820
1835
RTCM, CMR,
ETC. OUT
DGPS
RECEIVER
OPERATING
SYSTEM
1825
PROCESSING
SOFTWARE
1830
POSITION
FIX IN
1810
VRS
FIXED POSITION
INPUT 1845
1840
USER
I/O
DEVICES
1850
VRS

FIG. 18

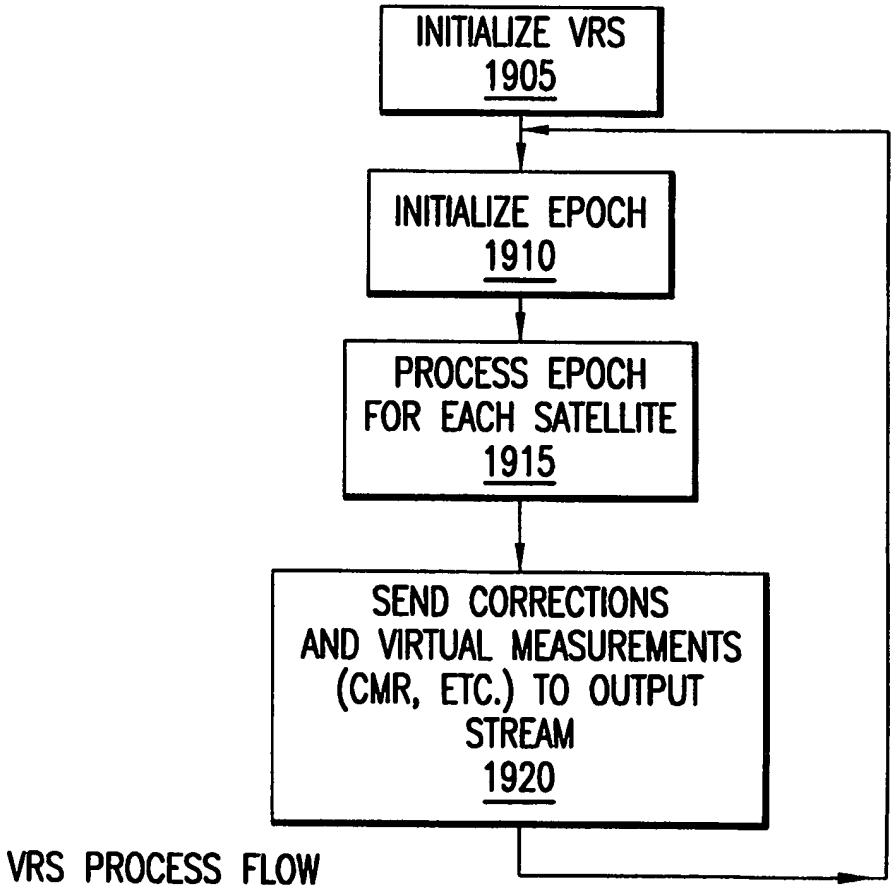

INITIALIZE VRS
1905
INITIALIZE EPOCH
1910
PROCESS EPOCH
FOR EACH SATELLITE
1915
SEND CORRECTIONS
AND VIRTUAL MEASUREMENTS
(CMR, ETC.) TO OUTPUT
STREAM
1920
VRS PROCESS FLOW

FIG. 19

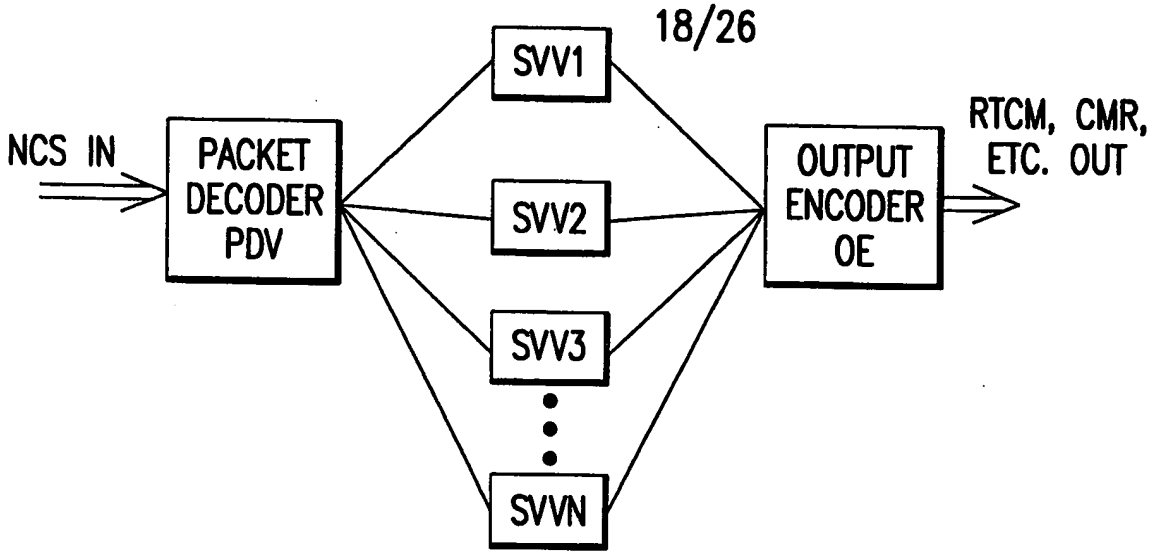

NCS IN
PACKET DECODER PDV
SVV1
SVV2
SVV3
SVVN
OUTPUT ENCODER OE
RTCM, CMR, ETC. OUT

FIG. 20

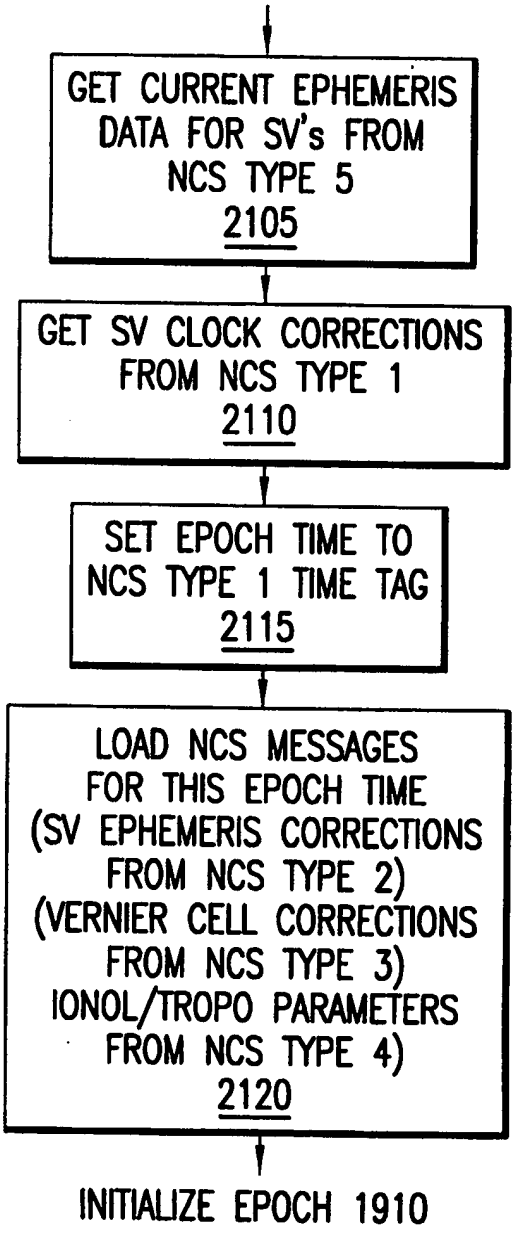

GET CURRENT EPHEMERIS DATA FOR SV's FROM NCS TYPE 5
2105
GET SV CLOCK CORRECTIONS FROM NCS TYPE 1
2110
SET EPOCH TIME TO NCS TYPE 1 TIME TAG
2115
LOAD NCS MESSAGES FOR THIS EPOCH TIME (SV EPHEMERIS CORRECTIONS FROM NCS TYPE 2) (VERNIER CELL CORRECTIONS FROM NCS TYPE 3) IONOL/TROPO PARAMETERS FROM NCS TYPE 4)
2120
INITIALIZE EPOCH 1910

FIG. 21

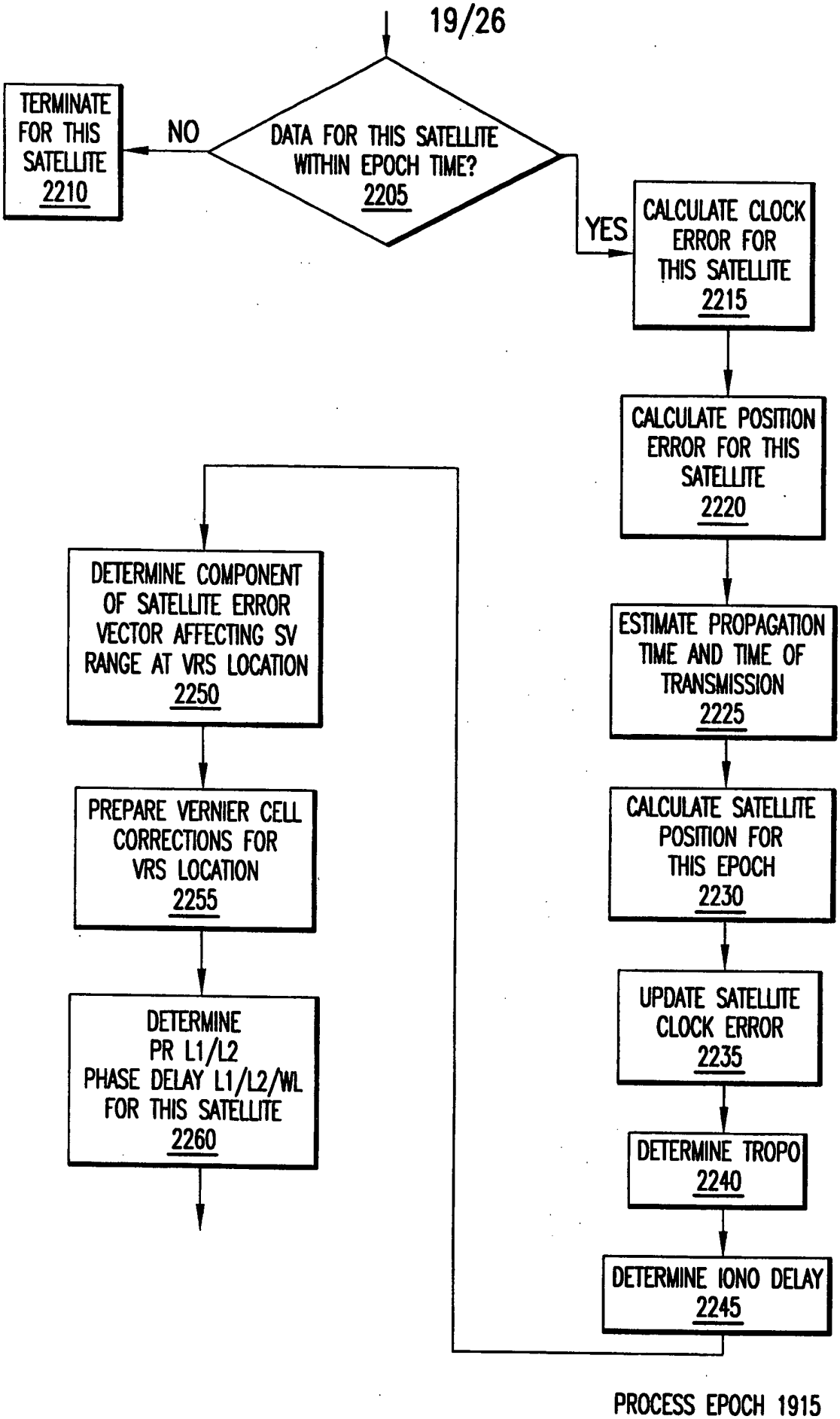
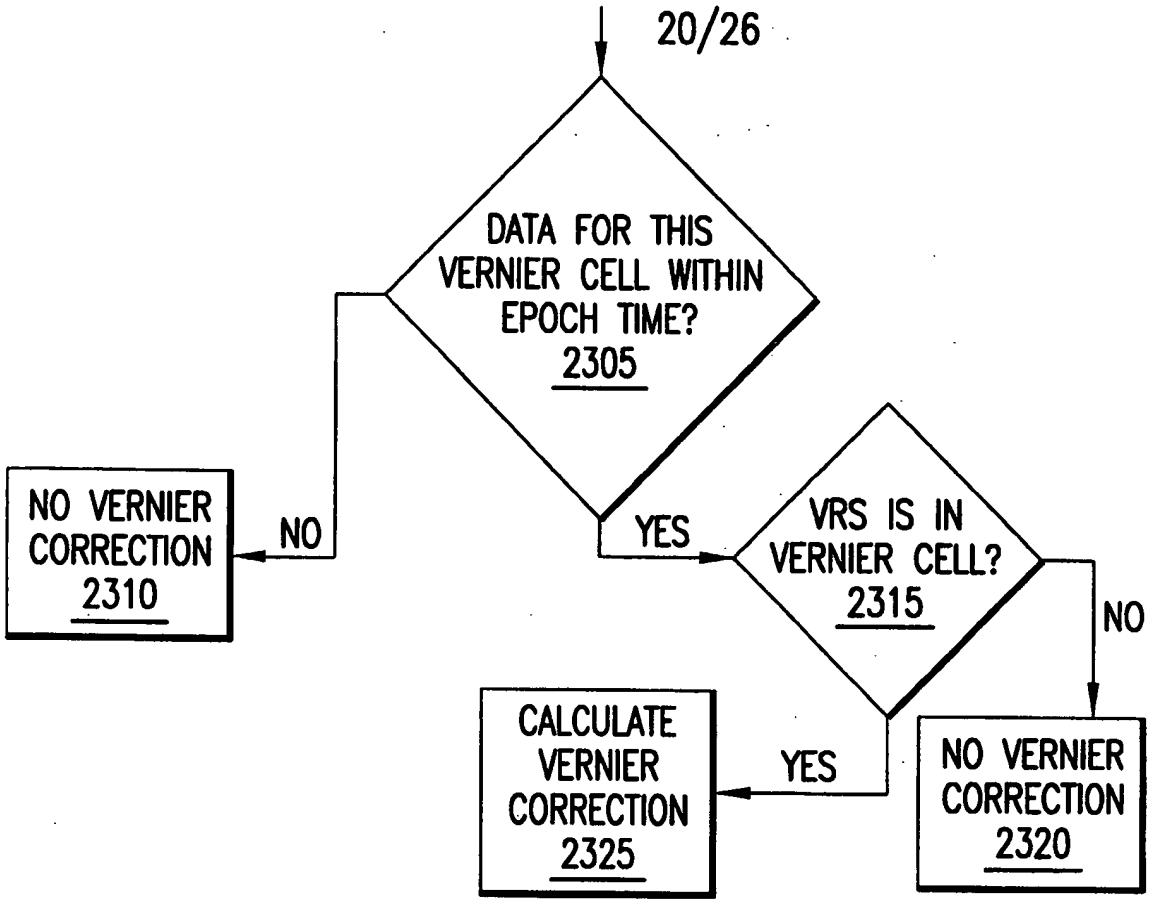

DATA FOR THIS SATELLITE WITHIN EPOCH TIME? 2205
NO
TERMINATE FOR THIS SATELLITE 2210
YES
CALCULATE CLOCK ERROR FOR THIS SATELLITE 2215
CALCULATE POSITION ERROR FOR THIS SATELLITE 2220
ESTIMATE PROPAGATION TIME AND TIME OF TRANSMISSION 2225
CALCULATE SATELLITE POSITION FOR THIS EPOCH 2230
UPDATE SATELLITE CLOCK ERROR 2235
DETERMINE TROPO 2240
DETERMINE IONO DELAY 2245
DETERMINE COMPONENT OF SATELLITE ERROR VECTOR AFFECTING SV RANGE AT VRS LOCATION 2250
PREPARE VERNIER CELL CORRECTIONS FOR VRS LOCATION 2255
DETERMINE PR L1/L2 PHASE DELAY L1/L2/WL FOR THIS SATELLITE 2260
PROCESS EPOCH 1915

FIG. 22



PREPARE VERNIER CELL CORRECTIONS
2255

FIG. 23

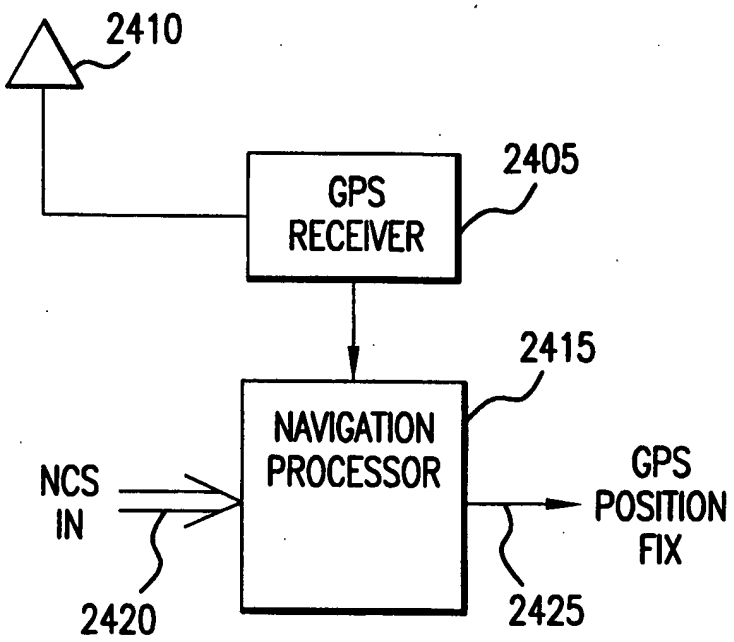


FIG. 24

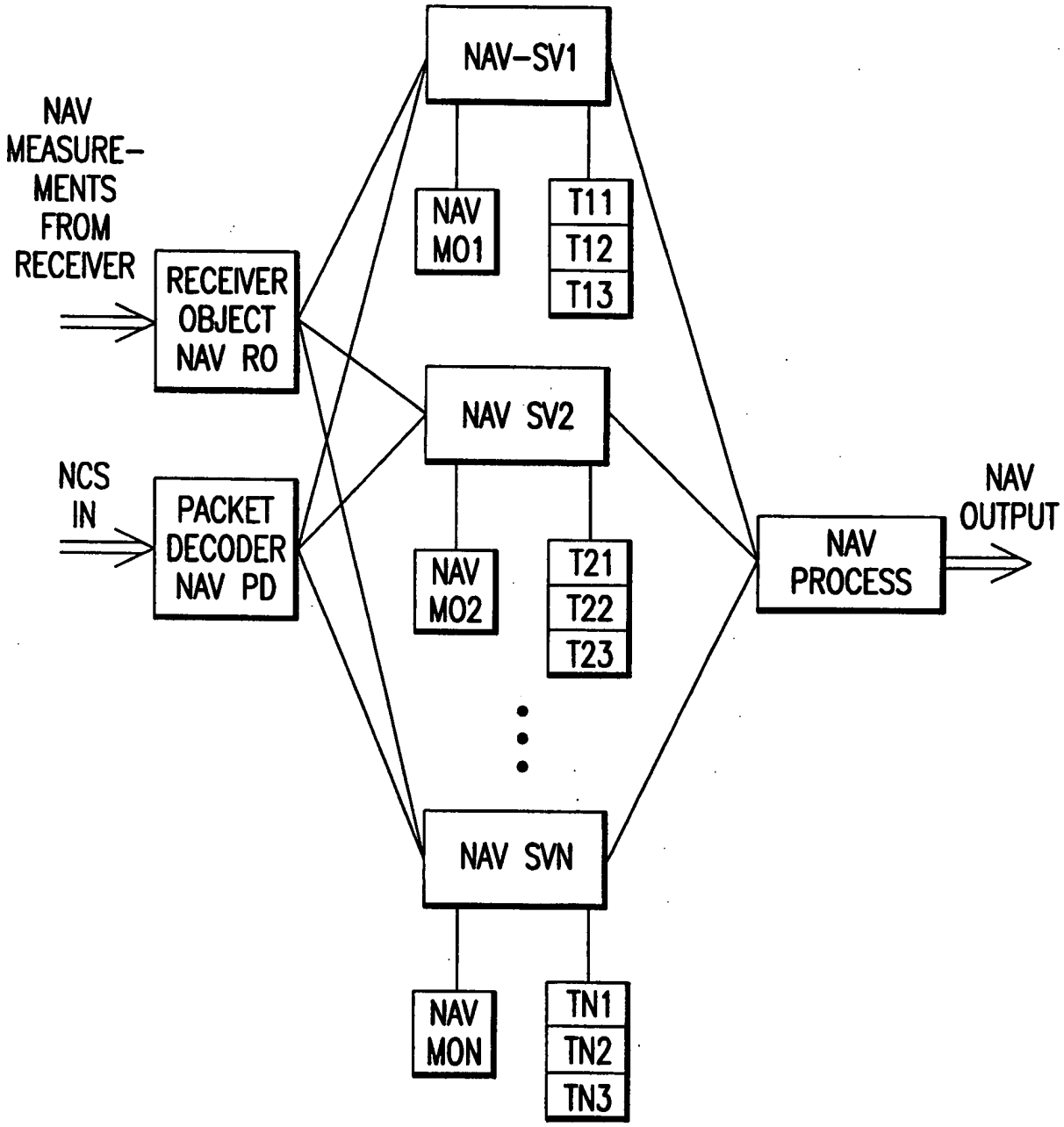
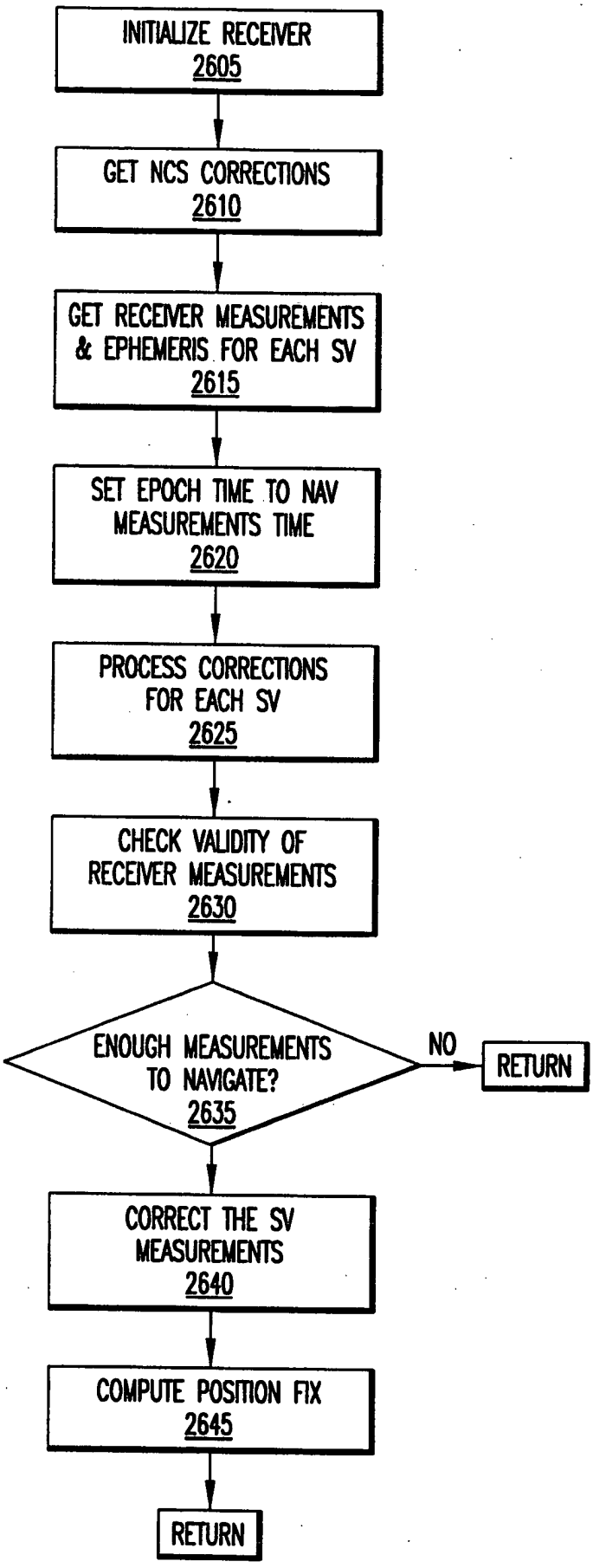

NAV
MEASURE-
MENTS
FROM
RECEIVER
RECEIVER
OBJECT
NAV RO
NCS
IN
PACKET
DECODER
NAV PD
NAV-SV1
NAV
MO1
T11
T12
T13
NAV SV2
NAV
MO2
T21
T22
T23
NAV SVN
NAV
MON
TN1
TN2
TN3
NAV
PROCESS
NAV
OUTPUT

FIG. 25



INTEGRATED NAVIGATOR MAIN PROCESS

FIG. 26

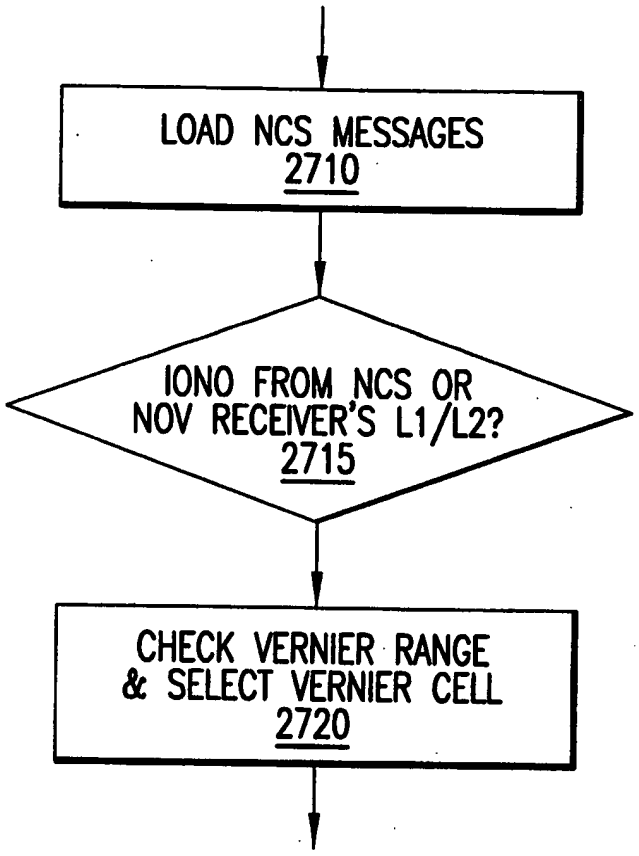

LOAD NCS MESSAGES
2710
IONO FROM NCS OR
NOV RECEIVER'S L1/L2?
2715
CHECK VERNIER RANGE
& SELECT VERNIER CELL
2720
GET NCS CORRECTIONS 2610

FIG. 27

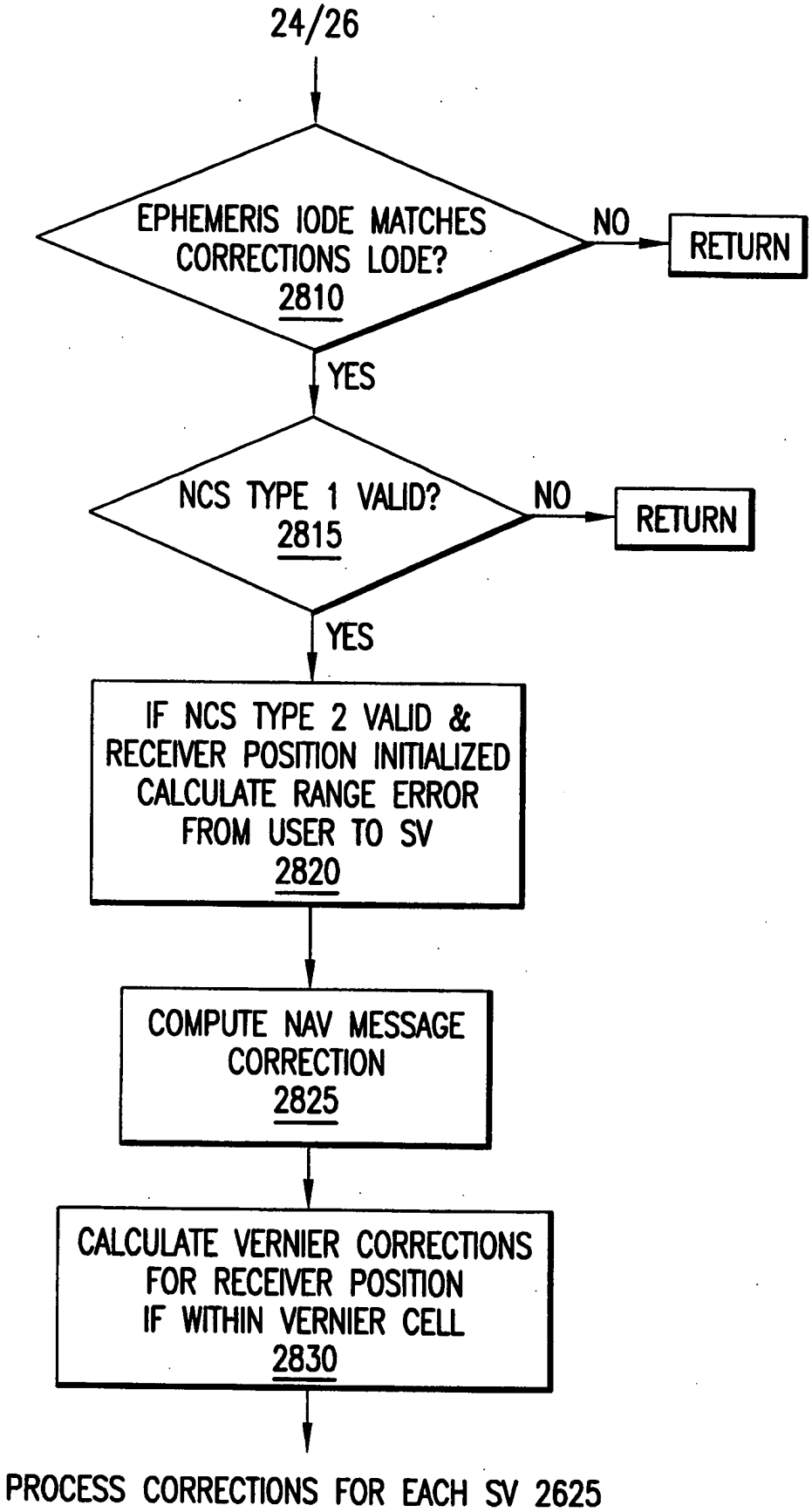

EPHEMERIS IODE MATCHES CORRECTIONS LODE?
2810
NO
RETURN
YES
NCS TYPE 1 VALID?
2815
NO
RETURN
YES
IF NCS TYPE 2 VALID & RECEIVER POSITION INITIALIZED CALCULATE RANGE ERROR FROM USER TO SV
2820
COMPUTE NAV MESSAGE CORRECTION
2825
CALCULATE VERNIER CORRECTIONS FOR RECEIVER POSITION IF WITHIN VERNIER CELL
2830
PROCESS CORRECTIONS FOR EACH SV 2625

FIG. 28

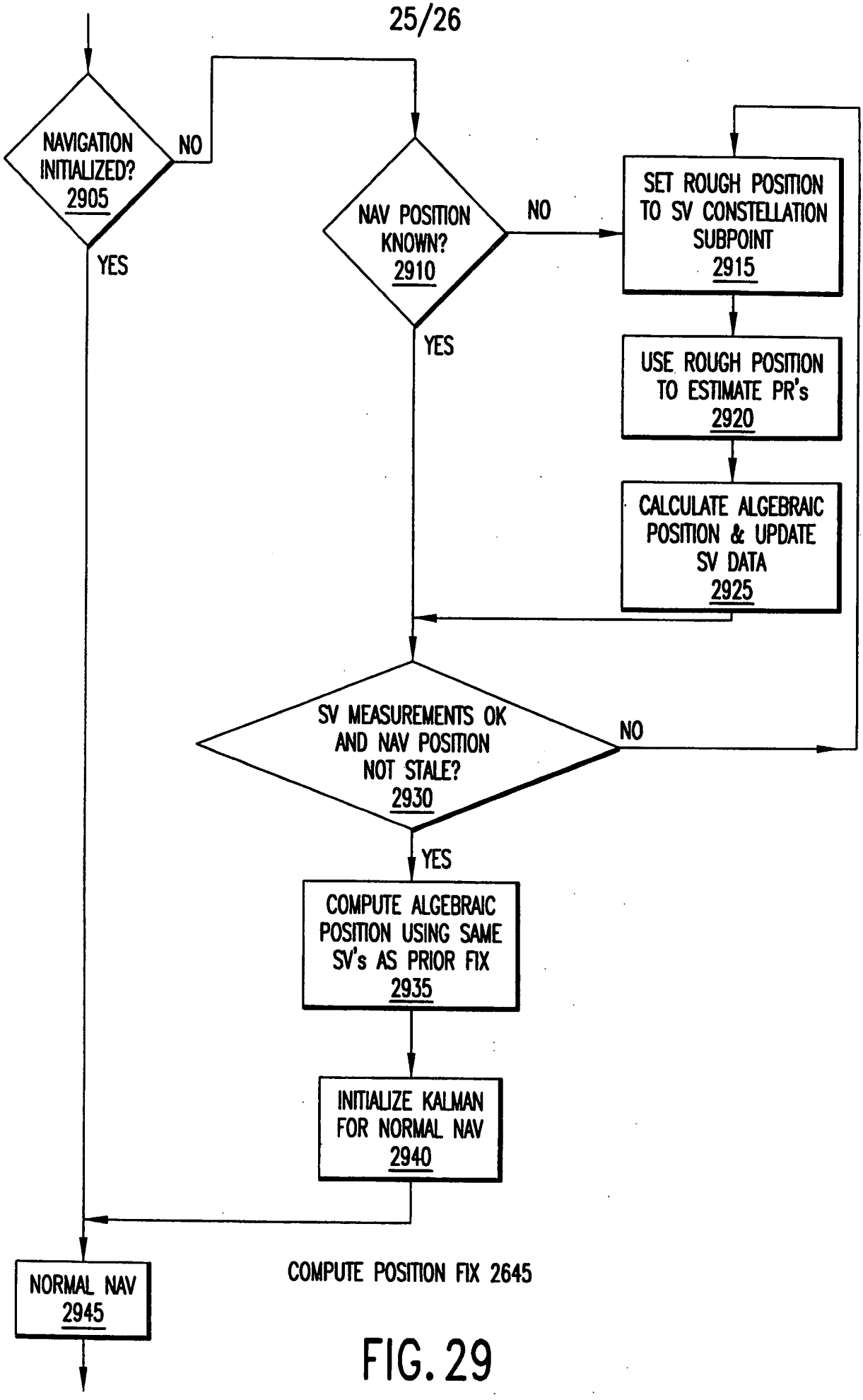

NAVIGATION INITIALIZED? 2905
NO
YES
NAV POSITION KNOWN? 2910
NO
YES
SET ROUGH POSITION TO SV CONSTELLATION SUBPOINT 2915
USE ROUGH POSITION TO ESTIMATE PR's 2920
CALCULATE ALGEBRAIC POSITION & UPDATE SV DATA 2925
SV MEASUREMENTS OK AND NAV POSITION NOT STALE? 2930
NO
YES
COMPUTE ALGEBRAIC POSITION USING SAME SV's AS PRIOR FIX 2935
INITIALIZE KALMAN FOR NORMAL NAV 2940
NORMAL NAV 2945
COMPUTE POSITION FIX 2645

FIG. 29

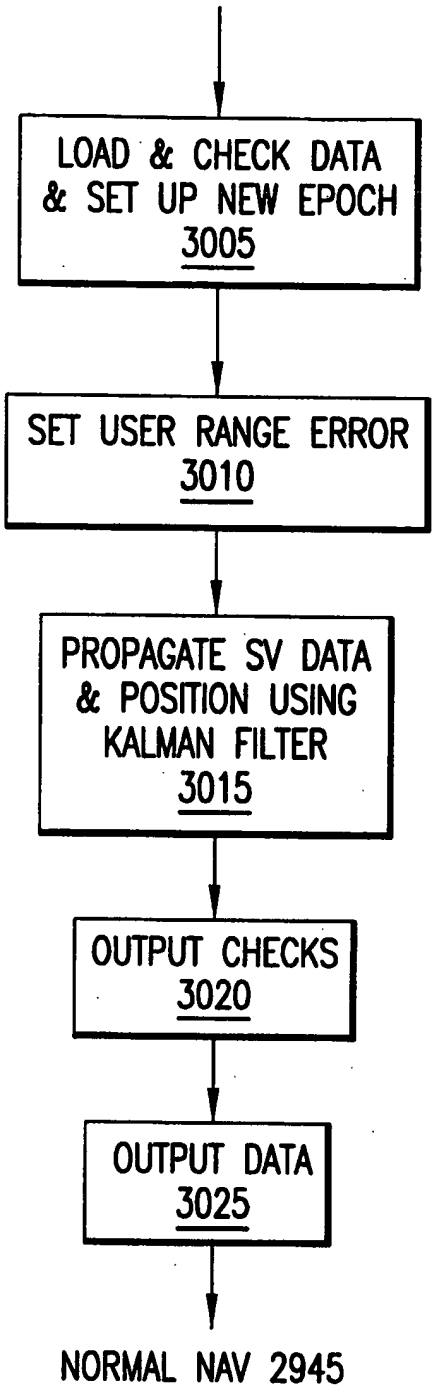

LOAD & CHECK DATA & SET UP NEW EPOCH 3005
SET USER RANGE ERROR 3010
PROPAGATE SV DATA & POSITION USING KALMAN FILTER 3015
OUTPUT CHECKS 3020
OUTPUT DATA 3025
NORMAL NAV 2945

FIG. 30